

**STATUS OF THE AMERICAN AVOCET
IN BRITISH COLUMBIA**

by
Martin B. Gebauer



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British Columbia, Canada's most westerly province, has a bounty of biological diversity. British Columbia's snowclad peaks, rain-drenched forests, arid grasslands, all sizes of rivers, lakes, and wetlands, and a long and rugged coast provide habitats for more species of living organisms than are found anywhere else in Canada. However, this very diversity means that there is much to be discovered about these organisms — their distribution, abundance, habitat requirements, and interrelationships with their environment. Increasing our knowledge of this biodiversity will help us with the complex task of sustainably managing our land and waters.

In 1992, the Provincial Government initiated a co-operative biodiversity research program with funding from the Corporate Resource Inventory Initiative, the British Columbia Ministries of Forests (Research Branch), Environment, Lands, and Parks (Wildlife and Habitat Protection Branches), and Tourism and Culture (Royal B.C. Museum), and the Forest Resource Development Agreement (FRDA II).

In 1995, the Ministry of Forests Research Branch and the Ministry of Environment, Lands and Parks developed a biodiversity research and extension strategy, with the assistance of the provincial research community. This strategy was presented to Forest Renewal BC (FRBC), who provided funding for a program beginning in 1995. The goal of the extension component of this program is to extend information to scientists, resource managers, and the public through biodiversity publications. These publications are intended to increase awareness and understanding of biodiversity, promote the concepts and importance of conserving biodiversity, and communicate provincial government initiatives related to biodiversity. We hope that they will be used as tools for the conservation of British Columbia's rich, living legacy.

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Wildlife Branch
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Wildlife Working Reports frequently contain preliminary data, so conclusions based on these may be subject to change. Working Reports receive little review. They may be cited in publications, but their manuscript status should be noted. Copies may be obtained, depending upon supply, from the Ministry of Environment, Lands and Parks, Wildlife Branch, P.O. Box 9374 Stn. Prov. Govt., Victoria, BC V8W 9M4.

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FOREWORD

In cases where a Wildlife Working Report or Bulletin is also a species' status report, it may contain a status recommended for the species by the author. This recommended status designation is the opinion of the author and may not necessarily reflect that of the Wildlife Branch. Official status designation will be made by the Wildlife Branch in consultation with experts, and the data contained in the status report will be considered during the evaluation process.

ABSTRACT

The American Avocet (*Recurvirostra americana*) is one of the more distinctive shorebirds in British Columbia. Its long bluish legs, long upcurved bill, and striking black and white body plumage, are enhanced during the summer with cinnamon colouring on its head and neck. The avocet was first reported in British Columbia in 1908 and was only seen on a handful of occasions after that until the 1960s. The first documented breeding record was of one nest at Duck Lake, near Creston, in 1968. Since then, it has been reported breeding at six other sites in the southern one-third of the province. Only at Alki Lake, Kelowna, has the American Avocet been known to breed in more than two years.

Nesting locations have generally been at alkaline lakes, where sparsely-vegetated shorelines or low islands were selected as nesting sites. Cultivated field and pond habitat used at Serpentine Fen, Surrey (1988 and 1989), were atypical of other known nesting habitats in the province.

Alki Lake, with a reported 19 breeding pairs in 1997, is imminently threatened by proposed landfill expansion. The other six ephemeral sites are either protected within Wildlife Management Areas (i.e., two sites) or are unprotected habitats (four) where significant disturbance is not anticipated in the near future.

The American Avocet is currently on the B.C. Wildlife Branch (1998) Blue List of vulnerable species. It did not make the Red List because populations, although small, were thought to be expanding in the province. Although breeding populations increased at Alki Lake up to 1997 (i.e., 19 nests), nesting attempts were down dramatically to only three nests in 1998. High water levels appear to be the main factor related to reduced nesting, however, remaining nesting and feeding habitats are also imminently threatened by land fill expansion. With the exception of one nest at Robert Lake in 1998, no other breeding locations have been reported in the province since 1995.¹ Given the apparent extreme vulnerability of nesting avocets in the province, this report recommends that the American Avocet be upgraded to Red List as a candidate for Endangered status.

Management recommendations include surveys for additional breeding areas in the province, conservation of known nesting areas, and research to support habitat enhancement or creation initiatives for the benefit of avocets. The most important research needs are centred at Alki Lake, the primary breeding location in British Columbia. They are:

- a) assessing habitat values (e.g., food availability, water chemistry, nesting substrates etc.) at Alki Lake, as compared to nearby sites (e.g., Robert Lake);
- b) documenting breeding ecology; and
- c) analyzing factors limiting breeding success.

Opportunities to retain, enhance or create habitats at Alki Lake, or nearby wetlands, need to be explored immediately.

¹Twelve avocets were discovered incubating nests on a single island in Little White Lake on June 1st, 1999. A total of 32 avocets was present at the lake and an adjacent small pond. Most avocet foraging activity appeared to be at the small pond (Les Gyug, pers. comm., 1999). The 1999 observation confirms the existence of a second major active colony in British Columbia.

ACKNOWLEDGEMENTS

The Central Okanagan Naturalists Club was instrumental in establishing the 'Avocet Committee' who initiated this project. A special thank you to the members of the Committee including Les Gyug, Gwynneth Wilson, Janice Casling and Denise Brownlie. Jason Weir deserves a special mention because of his detailed research on avocet breeding ecology at Alki Lake in 1997, which in a large part, provided the impetus for a serious review of the status of American Avocet in British Columbia. The British Columbia Nest Records Scheme provided information on American Avocet breeding records.

A number of people were contacted regarding the occurrence of avocets in the province and their concerns for the important Alki Lake breeding site. Dan Huang, Alan Newcombe, and Mark Watt provided reports specific to Alki and Robert lakes in Kelowna. A special thank you to the naturalists who provided sighting records of avocets. They include, Jack Bowling, Wayne Campbell, Dick Cannings, Syd Cannings, Chris Charlesworth, Les Gyug, Rick Howie, Chris Siddle, and Jason Weir.

Consultations with government personnel, including Rob Butler, Wayne Campbell, Myke Chutter, Orville Dyer, Rick Howie, and Dave Fraser, provided useful information and a framework for this report. Funding for this project was provided by the City of Kelowna and managed through the Central Okanagan Naturalists Club. Partners in the conservation of avocets in Kelowna include the Canadian Wildlife Service, Okanagan University College, B.C. Ministry of Environment, Lands and Parks, and the City of Kelowna.

A final thank you to Wayne Campbell, Myke Chutter, Orville Dyer, Les Gyug, Alan Newcombe, Mark Watt, and Jason Weir for reviewing an earlier draft of this status report.

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1 INTRODUCTION

In North America, Robinson et al (1997) state that populations of the American Avocet (*Recurvirostra americana*) declined rapidly in the late 1800s and early 1900s, particularly in eastern areas of their range. Habitat loss and shooting appear to be the primary factors causing the population declines. Since the mid-1900s, populations appear to have stabilized, largely due to the decreasing rate of habitat loss and the increasing availability of artificial habitats such as salt pans, coastal impoundments, and sewage lagoons. In British Columbia, records of avocets have increased since they were first reported in 1908 (Campbell 1972). Breeding birds were first reported in 1968 in the west Kootenay and, up to 1997, were reported sporadically at only six other, widely separated locations (see 4.2.1. "Breeding" and Table 1). In 1997, a colony of 19 pairs was reported at Alki Lake in Kelowna (Weir 1997a), and it is probable that several pairs also nested in the two or three years previous to 1997. Although most of the ephemeral breeding sites known for the province are under no immediate threat of destruction, the most important site, Alki Lake in Kelowna, is threatened by a proposed expansion of the Glenmore Land Fill.

The purpose of this report is to synthesize information relevant to American Avocet populations and breeding range in British Columbia. An overview of information on biology, habitat requirements, distribution, limiting factors, and status is provided. Information was gathered from local naturalists, government biologists, published literature, and unpublished reports. The primary objective of the report is to determine the status of the American Avocet in the province and to make recommendations to ensure that viable breeding populations are present in the future. This report is part of an ongoing program of the British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch to more effectively manage species-at-risk for long-term population viability.

2 GENERAL BIOLOGY

2.1 Reproductive Capability

The clutch size of the American Avocet generally ranges from three to five eggs, with four being the

most common (Bent 1927; Kondla and Pinel 1978; Godfrey 1986; Baicich and Harrison 1997). Two nests at Serpentine Fen in 1988 each contained four eggs (Wilson 1989). Of 14 clutches documented by Weir (1997a) at Alki Lake, Kelowna, eight nests had four eggs, four nests had five eggs, one nest had seven eggs, and one nest had eight eggs. Superclutches (i.e., more than five eggs) have been reported by several other researchers (Kondla and Pinel 1978; Giroux 1985; Kuyt and Johns 1992). Gibson (1971) and Giroux (1985) found hatching success in avocet nests containing three or four eggs to be much greater than nests with eight eggs. Sordahl (1996) also found poor success of superclutches. These findings differed from those of Weir (1997a) who determined that both superclutches studied at Alki Lake were highly successful, with only one egg from the largest clutch not hatching. Studies by Shipley (1984) determined that artificially created superclutches also had a high hatching success rate. Superclutches appear to be the result of two females laying in one nest rather than a result of several females dumping eggs. One clutch of five eggs had two distinct size and color groups indicating two females at Alki Lake in 1997 (Weir 1997a). Clutches of six or more eggs appear to be most common in dense colonies and at the northern edges of the breeding range (Giroux 1985; Robinson et al. 1997).

The incubation period is 22 to 29 days, and the fledgling period is 27 to 35 days (Gibson 1971; Ehrlich et al. 1988). Weir (1997a) determined approximate incubation periods of 27 eggs at Alki Lake as ranging between 22 and 31 days. Both males and females develop brood patches with the male incubating more frequently during the first eight days, and the female incubating primarily during the latter 16 days of the incubation period (Ehrlich et al. 1988; Sordahl 1996). Since avocets lay eggs at an approximate rate of about one egg per day, time required to complete a four egg clutch is four to five days (Robinson et al. 1997). The incubation period may begin as soon as the first egg is laid, but may depend on local ambient temperatures (Robinson et al. 1997).

Weir (1997a) recorded two nests at Alki Lake in 1997 which contained eggs by 6 May, indicating that nest-building and egg-laying occurred shortly after the arrival of birds. Adults were observed incubating eggs in fifteen nests by 13 May, 1997. Gibson (1971)

found first clutches at a breeding colony in central Oregon in 1967, 1968 and 1969 as 7 May, 7 May and 24 April, respectively, with egg laying reaching a peak between 11 and 20 May. Robinson et al. (1997) found nests with eggs between 16 April and 25 July. Hatching dates of 48 eggs at Alki Lake ranged from 26 May to 1 July (Weir 1997a). Hatching date of eggs monitored by Gibson (1971) ranged from approximately 20 May to mid July, similar to hatching dates between 19 May and 25 July reported by Robinson et al. (1997). The first date eggs hatched at Serpentine Fen was 19 June (Wilson 1989).

Overall hatching success of 87 eggs at Alki Lake was estimated at 77%; fifteen eggs were abandoned, including two complete clutches of four and five eggs (Weir 1997a). Hatching success was similar to that of 79% for 300 eggs at a colony in central Oregon (Gibson 1971). Low hatching success was reported for a highly depredated colony in northern Utah where only 28% (i.e., 80 of 290 eggs) hatched.

Existing literature supports the notion that avocets form monogamous bonds during the breeding season. Colonial nesting is an important component of the reproductive strategy of avocets.

2.2 Recruitment

Most mortality occurs early in the life history of American Avocets. Survival rate of fledglings, to breeding age at two years, has been estimated at 57.5%, and annual survival of adults has been estimated to range between 83 and 86% (Robinson et al. 1997).

2.3 Nest Structure and Composition

Nest structure and materials have been described for most nests reported in British Columbia. At Duck Lake, near Creston, a single nest consisted of a sparse collection of rootlets and grasses (Campbell 1972). A nest at Beresford Lake consisted of a small depression lined with grasses and rootlets (Campbell et al. 1990), and two nests at Serpentine Fen were lightly lined with dry grass (Wilson 1989). Weir (1997a) provided a detailed description of nests located at Alki Lake in 1997. All nests consisted of grass leaves and stalks, and/or leaf stocks of other plants. Some nests consisted of sparsely lined depressions in island substrates whereas other nests were piled high with vegetation. Nest structure,

location and materials reported in British Columbia are similar to those reported by Robinson et al. (1997). A general trend at Alki Lake appeared to be that nests closest to the water were comprised of the greatest amount of nesting material (Weir 1997a). The greatest nest height amongst 14 nests was 0.8 cm. Some researchers have reported that the avocet builds up nest heights in response to rising water levels (Koenigstedt et al. 1991; Robinson et al. 1997).

2.4 Species Movement

2.4.1 Seasonal migration

The American Avocet has been recorded in the province between 10 April and 04 December (Campbell et al. 1990). In the interior, in the Okanagan Valley, it has been reported as early as 16 April (C. Charlesworth, pers. comm.). Twenty birds were observed at Alki Lake on 18 April, 1997 (Weir 1997a). According to Cannings et al (1987) the primary movement in the spring occurs in the first two weeks of May, and most birds appear to move along larger lakes (e.g., Okanagan Lake) during migration.

Fewer birds have been observed during the autumn (see Appendix 1). Only one bird, at Iona Island, has been reported as remaining into October, November and December (Campbell et al. 1990). The primary departure period in the autumn appears to be between mid-August and mid-September (Campbell et al. 1990).

2.4.2 Diurnal movements

During the breeding season, avocets observed at Alki Lake appeared to remain and forage during the day (J. Weir, pers. comm.). In spring, some avocets were reported arriving at Chichester Bird Sanctuary, approximately six kilometres from Alki Lake, Kelowna, at dusk and leaving before sunrise (C. Charlesworth, pers. comm.). Birds were observed foraging soon after arriving. Several authors have documented nocturnal feeding in avocets (see 3.1.2 "Summer Foraging"). Individuals observed at Chichester were either nonbreeding individuals, migrants, or avocets which may later have nested at Alki Lake.

2.4.3 Post-hatching dispersal

Adults with recently hatched young often disperse to areas suitable for chicks to feed and hide from predators (e.g., shallow water with vegetation for cover). In general, vegetation in these areas is shorter than the adult, but taller than the chick, and is sufficiently open to allow chicks to move freely while foraging (Robinson et al. 1997). In northern Utah, Sordahl (1996) located adults with two day-old young up to 800 m away from the nest site. One brood traveled almost 1.5 km away from the nest site by 13 days age. The low number of hatched young observed by Weir (1997a) at the Alki Lake breeding site may be a result of dispersal of adults and young to other areas where chicks were less conspicuous.

2.5 Tolerance to Human Disturbance

Researchers in California found that avocets are relatively sensitive to human disturbance around the nest early in the incubation cycle, but that later in the cycle (i.e., within 2-3 days of clutch completion) nests can be monitored, and eggs can be sampled without much risk of nest abandonment (J. Skorupa, pers. comm.). Avocets appear to be easily disturbed during the migratory period by the presence of vehicles, airplanes, humans, or dogs (Robinson et al. 1997).

2.6 Food

Food of the American Avocet consists mostly of crustaceans, insects, aquatic vegetation, and seeds (Ehrlich et al. 1988). Bent (1927) noted that about two-thirds of the total diet consisted of animal foods such as phyllopod crustaceans, dragonfly nymphs, backswimmers, water boatmen, and beetles and flies and their larvae. Important food items for avocets have included chironomids (Chepeau and Le Dreun Quenec'Hdu 1995; Safran et al. 1997; Davis and Smith 1998), water boatmen (Grover and Knopf 1982) and brine shrimp and brine flies in highly saline and alkaline lakes (Mahoney and Jehl 1985). A detailed analysis of food preferences by Davis and Smith (1998) indicated that animals from the Diptera (fly larvae), Coleoptera (adult and larval beetles), Hemiptera (water boatmen), Annelida, and Crustacea families were utilized to the greatest extent by avocets. Utilization of fish, salamanders,

grasshoppers, seeds and bits of vegetation were also reported by Davis and Smith (1998).

2.7 Adaptability to Sudden Environmental Change

Generally, the American Avocet appears to adapt quickly to changes in habitat availability, but populations will decline if habitat is permanently lost (Robinson and Oring 1997). Several studies have shown that populations increase rapidly in areas where artificial habitats have been provided (Giroux 1985; Hill 1989; Burgess and Hirons 1992; Velasquez 1992). Nests of avocets are particularly susceptible to flooding resulting from heavy spring rains or artificial manipulation of water levels (Grover and Knopf 1982; Sordahl 1996). Adults will attempt to renest if suitable habitat is available early in the nesting period (Robinson et al. 1997).

2.8 Causes of Mortality

2.8.1 Adult and young mortality

Adult avocets in northern Utah were killed by the Red Fox (*Vulpes vulpes*), and possibly Great Horned Owl (*Bubo virginianus*) (Sordahl 1996). Coyotes were considered to be a major predator at avocet colonies in Nevada (J. Robinson, pers. comm.). Other wildlife species documented to have preyed on the American Avocet have included Northern Harrier (*Circus cyaneus*) (William et al. 1989), and Peregrine (*Falco peregrinus*) and Prairie (*Falco mexicanus*) falcons (Porter and White 1973, as cited in Sordahl 1982). A Peregrine Falcon was observed taking a dive at a flock of 12 avocets at Alki Lake in 1997 (J. Weir, pers. comm.). Coyotes (*Canis latrans*) are expected to be potential predators of young avocets in British Columbia. A family of Golden Eagles (*Aquila chrysaetos*) observed in autumn 1997 near Alki Lake, appeared to be preying on waterbirds, and may also be a potential predator of young avocets (J. Weir, pers. comm.).

A study on Pied Avocet (*Recurvirostra avosetta*) population dynamics in Britain noted that shooting, lead poisoning, and collisions with transmission power lines were causes of mortality (Cadbury and Olney 1978), though these mortality factors are not considered to be of any major concern in British Columbia. American Avocets are also particularly

susceptible to botulism poisoning (Robinson et al. 1997), and contaminants in some areas may also result in mortality (see Limiting Factors below).

In addition to these factors, mortality of young birds has been associated with unseasonably cold storms, leg injuries, and movements from nest areas to nursery sites (Robinson et al. 1997).

2.8.2 Egg Mortality

Depredation of eggs accounted for 57% of nest losses in a study by Sordahl (1996) in northern Utah. The major predators of American Avocet eggs in Utah were considered to be California Gull (*Larus californicus*), Ring-billed Gull (*Larus delawarensis*), and Red Fox. Other species that appeared to have depredated nests included Striped Skunk (*Mephitis mephitis*), Long-tailed Weasel (*Mustela frenata*) and Black-billed Magpie (*Pica pica*). Additional wildlife species documented to have depredated avocet nests have included Badger (*Taxidea taxus*; Gibson 1971), Coyote (Grover and Knopf 1982; Alberico 1993), Common Raven (*Corvus corax*; Alberico 1993), Gopher Snake (*Pituophis melanoleucus*) and Raccoon (*Procyon lotor*) (Gibson 1971). Common Ravens appeared to be a risk factor at Alki Lake in 1997 where avocets were observed on several occasions vigorously chasing a Common Raven out of the vicinity of the lake (J. Weir, pers. comm.). Coyotes, gulls, and Common Ravens are expected to be the major predators of American Avocet nests in British Columbia.

Eight percent of nest failures at the Barrens in northern Utah were due to flooding (Sordahl 1996), and flooding was also shown to cause destruction of avocet nests in Oklahoma (Grover and Knopf 1982). Eggs are also trampled by grazing livestock and contaminants in some areas may result in nest failures (Robinson et al. 1997; see 7 "Limiting Factors").

3 HABITAT

3.1 Habitat Description

3.1.1 Breeding

Nesting American Avocets are known to select sparsely-vegetated habitats (Bent 1927; Colwell and Oring 1990; Sordahl 1996), often on islands, if

available (Kondla and Pinel 1978; Goutner 1997; Robinson et al. 1997). Giroux (1985) noted that avocets appeared to prefer islands surrounded by deeper water, while Alberico (1993) also noted that nesting success was related to water depth, with successful nests surrounded by water deeper than 0.75 m.

Breeding has been reported at seven locations in British Columbia, most of which were alkaline lakes. Habitat descriptions of the nest sites, most of which were on lightly vegetated areas on islands or lake shores, are described below:

- a) **Duck Lake, Creston (1968):** The single nest site was completely exposed on a sparsely vegetated mud flat, apparently created by a temporary drawdown of water levels in the lake, and was approximately 100 m from the shoreline of the lake. The height of surrounding vegetation did not exceed four centimetres (Campbell et al. 1990).
- b) **Beresford Lake, Kamloops (1987):** The single nest site was located three metres from the shoreline on an alkaline, bare substrate (Campbell et al. 1990).
- c) **Serpentine Fen, Surrey (1988 and 1989):** In 1988, two nests were located in an uncultivated field which held persistent wet spots into June. The nests were on a "low island" of sparse hummocky vegetation, about 100 metres square, with extensive mudflats to the north, east, and south, and a ditch on the west (Wilson 1989). Wilson (1989) also reported that a pair successfully raised a brood at the fen in 1989.
- d) **Robert Lake, Kelowna (1992 and 1998):** A single nest in 1992 was located on alkaline flats, 15 to 20 m from the shoreline. The nest was located on bare substrates between two deep ruts at the southwest corner of the lake (C. Siddle, pers. comm.). In 1998, a single nest was located on 18 June on a sparsely-vegetated (i.e., approx. 10% cover, with vegetation <3cm high) mudflat approximately 30 m from the shoreline of Robert Lake. The mudflat had been completely water covered in April but had been exposed because of pumping of water. In years when water levels

are low, the mudflat area appears to have been cultivated as part of the adjacent hayfield. Several low (<10cm) straight mounds and furrows were present, and the nest was at the height of one of the low mounds. Knee-height vegetation at the nest site in July almost completely covered the soil surface (L. Gyug, pers. comm.).

- e) **Alki Lake, Kelowna (1987, 1997 and 1998):** Though four adults and six young representing two broods were observed at Alki Lake in 1987 (Cannings et al 1987), no nesting habitat description is provided. Nineteen nests were reported at Alki Lake in 1997 (Weir 1997a). Alki Lake is an alkaline slough, which during low water in 1997, was dotted by approximately 70 small islands, and four larger islands. A large portion of the northern end of the lake is being utilized as the City of Kelowna's Glenmore Land Fill site. All 19 avocet nests were located on small islands, and situated 21 to 140 m from the shoreline. Ten nests were on flat clay, sparsely vegetated islands, and were situated within 12 cm of water. Three nests were built on submerged grass-covered islands inundated with water several centimetres deep, and one nest was built up over the water. The remaining five nests were on islands at elevations ranging from 30 to 60 cm above water levels in the lake. Island size ranged from 0.8 x 0.8 m to 12 x 31 m. Mean distance to water for 15 nests was 1.8 m. Although vegetation height was low on the islands during most of the nesting season, by early July, Foxtail Barley (*Hordeum jubatum*) covered most of the islands. Maximum water depth of Alki Lake was 1.4 m, with an average estimated depth of 0.8 m (Weir 1997a). Of three nests at Alki Lake in 1998, two were on a dike (one metre or more above water levels) separating the lake from a water canal used to provide irrigation water for adjacent hayfields. The third nest was on an island of about one metre diameter (L. Gyug, pers. comm.).

- f) **Little White Lake, Clinton (1995):** The single nest was located on bare substrate on the edge of the lake (S.G. Cannings, pers. comm.)²

- g) **"White Lake", Douglas Lake area (1990 and 1991):** The immediate habitat around the nests included sparsely vegetated upland within 40 m of the lakeshore. Large patches of bare substrates were present (R.W. Campbell pers comm 1999).

3.1.2 Summer foraging

Avocets breeding at Alki Lake, Kelowna, in 1997 fed extensively in the shallows surrounding their nesting islands (Weir 1997a). C. Charlesworth, (pers comm 1998) reported as many as eight birds were observed (likely either nonbreeders or migratory birds) on five occasions between 25 April and 24 May 1997 feeding in shallow pools at nearby wetlands at dusk (e.g., Chichester Bird Sanctuary). All birds were gone by sunrise. Nocturnal feeding by nonbreeding American Avocets has been reported by a number of other authors (Chepeau and Le Dreun Quenec'Hdu 1995; Dodd and Colwell 1996; Velasquez 1992). Robinson et al. (1997) noted that avocets generally feed in water less than 15 to 20 cm deep.

3.1.3 Summer roosting

Little information is available on summer roosting habitats of the American Avocet. Islands are known to provide important roost sites in winter (Evans and Harris 1994), and are expected to be important at breeding sites such as Alki Lake.

3.1.4 Staging

On the coast of British Columbia, the American Avocet has most often been recorded from mud flats, estuaries, ponds, and sewage lagoons, but sand spits, and muddy coast lines and lake shores have also been utilized (Campbell et al. 1990). In inland areas of British Columbia, habitats have included alkaline

² Twelve avocets were discovered incubating nests on a single island in Little White Lake on June 1st, 1999. A total of 32 avocets was present at the lake and an adjacent small pond. Most avocet foraging activity appeared to be at the small pond (Les Gyug, pers. comm., 1999). The 1999 observation confirms the existence of a second major active colony in British Columbia.

ponds, lowland marshes, shorelines of larger lakes, and sewage lagoons (Campbell et al. 1990).

Studies on wintering American Avocets in South Carolina have shown a strong relationship between avocet use, and water depth and water fluctuations (Boettcher et al. 1995; Weber and Haig 1996). The studies found that most avocets used water between 8 to 17 cm deep with little or no exposed substrate. Wintering avocet numbers were shown to decrease in areas experiencing large fluctuations in water level (i.e., 6 to 10 cm) (Boettcher et al. 1995; Chepeau and Le Dreun Quenec'Hdu 1995; Weber and Haig 1996; Safran et al. 1997).

3.2 Habitat Distribution

Suitable nesting habitats may be available at many of the alkaline lakes in the Southern Interior Ecoprovince, and the southern portions of the Central Interior and Southern Interior Mountains Ecoprovinces of British Columbia. Many of these widely distributed lakes are rarely visited during the prime breeding period of avocets. High potential breeding sites may exist throughout the dry interior of the province. For the known locations of habitats used by breeding birds, see 3.1 "Habitat Description" above. Although nesting has not been confirmed, a pair of avocets observed over several years south of Armstrong suggest that suitable breeding habitat may exist in this area (J. Weir, pers. comm.).

3.3 Trend in Quality and Quantity of Critical Habitat

An analysis of suitable nesting habitats for the American Avocet in the province has not been conducted, therefore, trends in habitat quality and quantity are difficult to determine. Although habitat availability may be stable currently, development pressures in the vicinity of important wetlands may result in significant habitat losses. A proposed expansion of the Glenmore Land Fill in Kelowna threatens to destroy habitat for the only known breeding colony (all other breeding sites had only one or two nests) of avocets in the province. (See footnote page 5). Various development proposals at Robert Lake (Tera Planning Ltd. 1993) also threaten this potentially highly suitable, alternate nesting habitat. The habitat quality of three other wetlands located in ranching areas of the province where nesting has been

documented (i.e., Beresford, "White", and Little White Lake) is undetermined. There does not appear to be any imminent development pressures on these wetlands as at present they are used only as pasture lands. In the future, increased recreational interest (e.g., dude ranches) in these areas may become an important human disturbance factor. Generally, however, alkaline lakes are of lower recreational value than other wetlands where water recreation activities are possible.

Alki Lake has been used since the mid 1960s as a landfill site by the City of Kelowna. In the mid-1980s, the City's lease on the southern half of the site was canceled. Prior to cancellation, refuse waste was buried in trenches and covered with clay, resulting in shallow ridges. These ridges were used as nest sites by avocets in 1997 and 1998, when surface water filled most areas of the southern half of the site. The northern half of the site has continued to be used as a landfill. The City has recently purchased the southern half of Alki Lake and plans to use it for garbage disposal within 10 years. The Ministry of Environment, Lands and Parks, Waste Management Program, is concerned about the escape of leachates and requires de-watering of the site. Both proposals would result in the loss of breeding habitat for avocets.

3.4 Present Habitat Status

The most important known breeding site in British Columbia, located at Alki Lake, is owned by the City of Kelowna and is slated to be destroyed as part of a proposed expansion of the Glenmore Land Fill. Alki Lake was not given a sensitivity rating (i.e., an unconfirmed site) in the recent 'Wetland Habitat Management Strategy' for Kelowna (Urban Systems 1998) because of the limited scope of the project. Basic inventory and assessment of Alki Lake is still pending, and will eventually be incorporated into the "Wetland Strategy". Robert Lake is owned privately by a number of landowners and is rated to be of Moderate Sensitivity by Urban Systems (1998). The Central Okanagan Parks & Wildlife Trust recently purchased a small section of Robert Lake in the lake's southwest corner. With this purchase, conservation concerns associated with development pressures in the vicinity of Robert Lake will now have a louder voice.

Two ephemeral avocet breeding locations, Serpentine Fen and Duck Lake, are protected within Wildlife Management Areas. Little White Lake is in Crown rangeland (D. Ogilvie pers comm 1999), while the two remaining sites, Beresford and "White" Lakes, appear to be privately owned. Potential status of other, undiscovered sites in the grasslands of the southern interior will most likely be privately owned, since very few protected areas are established in suitable habitat.

4 DISTRIBUTION

4.1 North America

4.1.1 Breeding

The American Avocet does not occur outside of North America. It breeds on the Pacific coast from San Francisco Bay south locally to northwest Baja California Norte in Mexico. In western inland areas, it breeds east of the Sierra Nevada and Cascade Mountains from southeast and central Washington, and southern Idaho to eastern Oregon, eastern California and western Nevada. Breeding has also been recorded from northern Idaho and in scattered locations across southern British Columbia. In central inland areas, it is known to breed from central Alberta, central Saskatchewan, and southwestern Manitoba south through most of the Great Plain states to central New Mexico and northwestern Texas. Breeding has been known to occur as far east as western Minnesota, central Iowa and western Oklahoma. Breeding also occurs in central Mexico. Resident breeding populations occur along the Gulf coast of Texas, but no longer occur on the Atlantic coast (Godfrey 1986; Semenchuk 1992; Howell and Webb 1995; Price et al. 1995; Nature Mapping 1997; Robinson et al. 1997; Breeding Bird Survey 1998). Figure 1 (inset) depicts the breeding range of the American Avocet in North America.

Extralimital breeding has been recorded in southwestern Ontario (Godfrey 1986), and the Northwest Territories (Kuyt and Johns 1992). The incidence of extralimital breeding appears to increase in drought years. Sewage lagoons of large southwestern cities such as Las Vegas, Phoenix, and Tucson also attract breeding avocets (Robinson et al. 1997).

4.1.2 Wintering

On the Pacific coast, the marshes of the California coast from Humboldt Bay (Evans and Harris 1994) and San Francisco Bay and the Central Valley (e.g., Salton Sea), south throughout Baja California, and along the western coast of Mexico are important wintering areas. Central areas of Mexico are also utilized during winter. On the Atlantic and Gulf Coasts, wintering occurs from Virginia south to the Atlantic and Gulf Coasts of Florida. The Gulf Coast of Texas south to the northern coast of the Yucatan Peninsula in Mexico also harbours important wintering areas. Avocets occasionally show up in winter in the West Indies and in Central America (Robinson et al. 1997).

4.2 British Columbia

4.2.1 Breeding

The American Avocet is known to have nested at seven locations in British Columbia: a) Duck Lake, Creston (Campbell 1972); b) Beresford Lake, south of Kamloops (Campbell et al. 1990); c) Alki Lake, Kelowna (Weir 1997a); d) Serpentine Fen, Surrey (Wilson 1989; Campbell et al. 1990); e) Robert Lake, Kelowna (C. Siddle, pers. comm.; L. Gyug, pers. comm.); f) Little White Lake, west of Clinton (B.C. Conservation Data Centre 1999); and g) "White" Lake, Douglas Lake area (W. Campbell, pers. comm.).

Nesting American Avocets occur only in the southern parts of British Columbia having been recorded in the Southern Interior Mountains, Southern Interior, Central Interior, and Georgia Depression ecoprovinces. Table 1 lists the ecoregions and ecosections where avocets have nested within these ecoprovinces. On a smaller scale, breeding has occurred in the Bunchgrass (BG), Coastal Western Hemlock (CWH), Interior Cedar-Hemlock (ICH), Interior Douglas-fir (IDF), and Ponderosa Pine (PP) biogeoclimatic zones (Table 1). Broad ecosystem units occurring at nesting sites include Bunchgrass - Grassland Step (BS), Cultivated Field (CF), Small Lake (SL), Meadow (ME), Shallow Open Water (OW), Unvegetated (UV), and Wetland (WE) (Table 1). The location of known breeding sites in the province is shown in Figure 1.

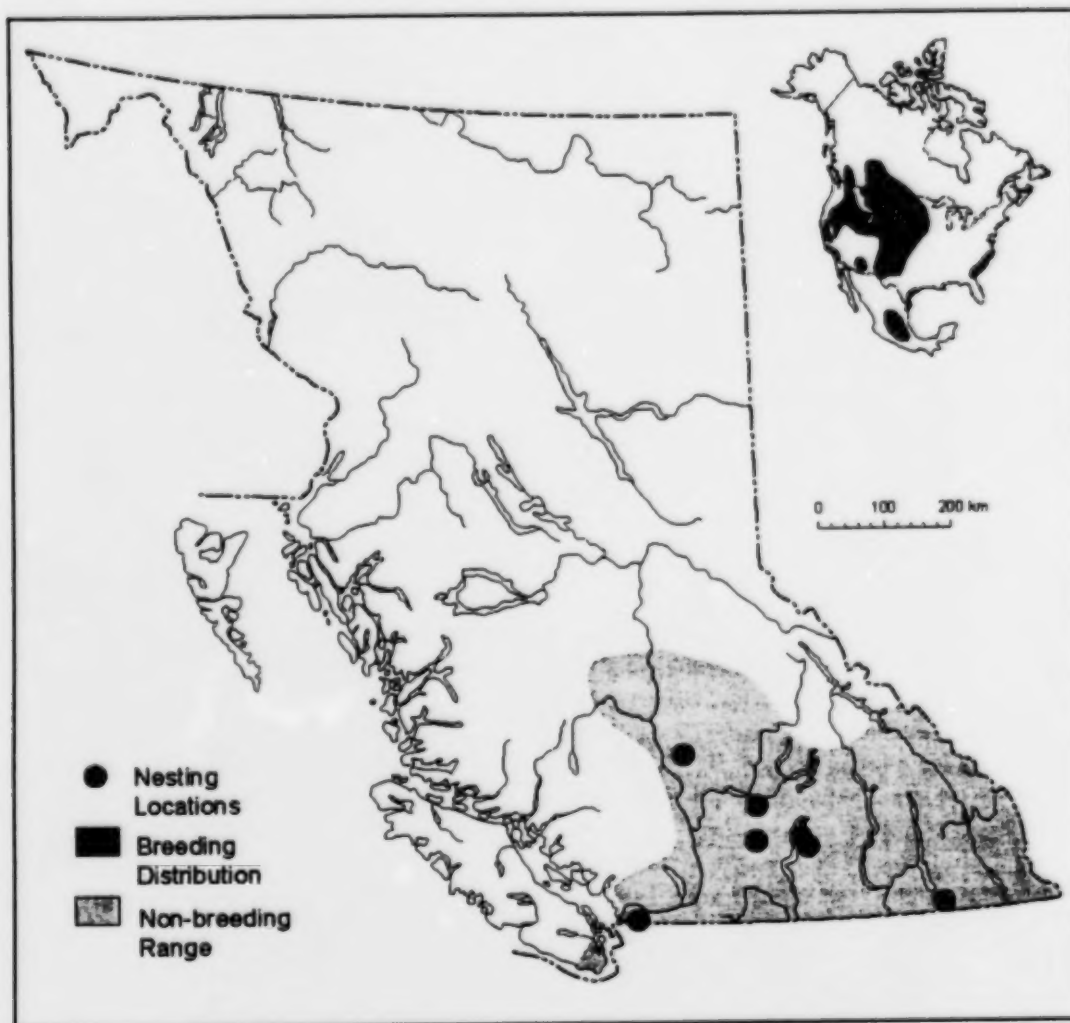


Figure 1. Known breeding locations and approximate nonbreeding range of American Avocets in British Columbia. Inset shows North American breeding range.

Table 1: Locations of known American Avocet breeding sites within the Ecoregion Classification system, biogeoclimatic zones (BGZ), and provincial broad ecosystem units (BEU) (from Demarchi 1995, and Province of British Columbia 1997) (See 4.2.1 "Staging" above for definition of codes).

Location	Ecoprovince	Ecoregion	Ecosection	BGZ	BEU
Duck Lake	Southern Interior Mountains	Northern Columbia Ranges	Southern Columbia Mountains	ICH	LS, OW, ME, UV
Beresford Lake	Southern Interior	Thompson-Okanagan Plateau	Southern Thompson Upland	BG	LS, OW, UV, CF, BS
Alki Lake	Southern Interior	Thompson-Okanagan Plateau	Southern Okanagan Basin	PP	LS, OW, CF, UV
Serpentine Fen	Georgia Depression	Lower Mainland	Fraser Lowland	CWH	WL, OW, ME, CF
Robert Lake	Southern Interior	Thompson-Okanagan Plateau	Southern Okanagan Basin	PP	LS, OW, CF, ME
Little White Lake	Central Interior	Fraser Plateau	Cariboo Basin	IDF	LS, OW, ME
White Lake	Southern Interior	Thompson-Okanagan Plateau	Southern Thompson Upland	IDF	LS, OW, BS

4.2.2 Staging

The American Avocet has been reported with increasing frequency in British Columbia over the last 30 years. Appendix 1 summarizes reported sightings in British Columbia. American Avocets observed in the Peace River lowlands are likely vagrants from breeding populations in central Alberta (Campbell et al. 1990). Sightings south of the Rocky Mountains are likely of birds originating from breeding sites in Montana and Washington, and Alki Lake, British Columbia. Individuals have been reported from Tofino, on the West Coast, north to the Cariboo-Chilcotin area, and east to the Columbia Basin in southeastern British Columbia (Campbell et al. 1990). Based on sighting records collected for this report, the approximate range of nonbreeding individuals in British Columbia has been estimated (Figure 1).

5 POPULATION SIZE AND TRENDS

5.1 Population Size

In 1997, a breeding population of 38 adults (i.e., 19 nests) was reported at Alki Lake, Kelowna (Weir 1997a). In 1998, the total number of nests at Alki Lake and Robert Lake was reduced to four,

apparently a result of high water levels (L. Gyug, pers. comm.). The highest number of avocets ever recorded at one location was 39 birds at Alki Lake on 16 May 1997 (Weir 1997a). No other breeding records were reported in British Columbia in 1997 or 1998 (British Columbia Nest Records Scheme), although it is possible that nesting has occurred at other, unreported locations. A pair of avocets observed for several years in the Armstrong area suggests that breeding may have occurred (J. Weir pers. comm.). Based on sighting records (see Appendix 1), the provincial population in any given year has likely never exceeded 50-75 birds (See footnote page 5.)

5.2 Population Trends

American Avocet population declines in western Canada were reported by Taverner (1934) in the 1920s and 1930s. Breeding populations were extirpated from much of the former eastern range in the early to mid-1900s (Robinson et al. 1997). Since that time, populations appear to have stabilized within a more restricted range (J. Robinson, pers. comm.). Breeding Bird Survey (1998) results indicate that on a survey-wide basis (i.e., Canada and North America), populations increased at a rate of 0.5% per

year between 1966 and 1996. For the same time period, population trends for Canada increased at 1.6% per year. Results for Alberta and Saskatchewan suggest that American Avocet populations are increasing at 1.5% and 2.0%, respectively. An analysis of trends within the four western states and provinces (i.e., British Columbia, Washington, Oregon and California) indicated an increasing trend of 0.6%. Overall, American Avocet populations appear to be stable or increasing very slowly. These results coincide with the increased occurrence of American Avocets in British Columbia up to 1997.

The American Avocet was first recorded in British Columbia on 28 April 1908, when Allan Brooks collected six from a flock of 15 near Okanagan Landing (Brooks 1909). Until the early 1960s, the American Avocet was recorded on only

five occasions from three locations (Campbell et al. 1990). Since then, avocets have been observed with increasing regularity, and breeding has been reported in seven locations (Cannings et al. 1987; Campbell et al. 1990). Weir (1997a) documented a total of 39 birds (19 nests) at Alki Lake near Kelowna in 1997. The maximum number of avocets reported at Alki Lake in 1998 was 23 (L. Gyug, pers. comm.), however, only three nests were located.

Although breeding populations in most locations have involved one or two pairs for a maximum of two years, the colony size at the Alki Lake site increased dramatically up to 1997. Table 2 summarizes maximum numbers of avocets observed at Alki Lake and Robert Lake between 1987 and 1998. Birds reported at Robert Lake are also included since they likely also utilize habitats at Alki Lake.

Table 2: Maximum numbers of avocets and nests reported at Alki (AL) and Robert (RL) lakes between 1987 and 1998.

Year	Number of American Avocets and Nests
1987	4 adults, 6 juveniles; (2 nests: AL)
1988	6 adult
1989	3 adult
1990	no records
1991	2 birds
1992	8 adults (1 nest: RL)
1993	1 adult
1994	8 adults
1995	10 adults
1996	18 adults
1997	39 adults (19 nests: AL)
1998	23 adults (4 nests: 3: AL, 1: RL)

6 LEGAL PROTECTION

The American Avocet, its nests and eggs, are protected from destruction, injury, molestation and possession. (i.e., hunting, egg-collection, etc.) under the international *Migratory Birds Convention Act* of 1994 signed by Canada, the USA, and Mexico; and in British Columbia by the *British Columbia Wildlife Act* of 1982.

As a species at risk that occurs on rangeland, it can also receive some habitat protection on Crown Land under the *Forest Practises Code of British*

Columbia Act. Under the Code, provisions in the Biodiversity Guidelines, Riparian Management Area Guidelines, and Range Use Plans could be used to address some of the habitat requirements of American Avocets. In addition, although the American Avocet is not listed as Identified Wildlife in the first volume of the Forest Practices Code Identified Wildlife Management Strategy (IWMS), it is a candidate for inclusion in volume 2. If included, it would enable critical habitat protection in the form of Wildlife Habitat Area (WHA) designation at major breeding sites on Crown lands.

7 LIMITING FACTORS

7.1 Availability of Nesting Habitat

Known breeding locations in British Columbia are widely scattered from south-coastal environments east to the east Kootenay. The status of reported breeding locations at Beresford Lake, "White" Lake, and Little White Lake is not known, and a detailed survey of suitable nesting locations in the southern interior has not been conducted. A breeding colony at Alki Lake is threatened by expansion of the Glenmore Land Fill.

7.2 Habitat Loss

Wetland losses and conversions have already led to significant population declines of American Avocets in most parts of their range. The proposed expansion of the Glenmore Land Fill in Kelowna will destroy the most critical breeding habitat for avocets in the province.

7.3 Water Fluctuations

Alberico (1993) found that populations of avocets in Nevada decreased from 1,000's of birds to fewer than 100 birds after a prolonged period of drought. He showed that a decrease in water levels, resulting from extended periods of drought, increases nest vulnerability to depredation because of increased access by terrestrial predators such as Coyote. Alberico (1993) also hypothesized that drought-induced shortages of key prey species for Common Raven may have resulted in increased depredation rates on avocet eggs. In BC, it is possible that drought could similarly increase predation effectiveness of other potential predators such as rats, Raccoon, and Mink (*Mustela vison*).

Dramatic increases in water levels during the nesting season can also result in destruction of nests and eggs (Grover and Knopf 1982; Sordahl 1996).

7.4 Predation

Predation (see previous discussion in 7.3 "Water Fluctuations" above) is a significant mortality factor of adults, young and eggs in some breeding locations in North America (Alberico 1993; Sordahl 1996; J. Robinson, pers. comm, 1999). Given the healthy

Coyote and corvid populations in British Columbia, it is possible that predation of adults, eggs and young is also a factor in limiting breeding success, although there are no documented records of such occurrences in British Columbia. The potential for raven predation at Alki Lake is high due to the large number of these birds attracted to the dump as a food source; however, the high hatching success of eggs at Alki Lake in 1997 (Weir 1997a) suggests that predation rates at the colony were relatively low that year.

7.5 Human Disturbance

Wintering or staging flocks of avocets are easily disturbed, taking flight in response to vehicles, presence of humans, and dogs (Robinson et al. 1997). Human research within colonies may also impact reproductive success, particularly early in the egg-laying cycle when avocets are most likely to abandon nests (Robinson et al. 1997). Breeding birds are likely also easily disturbed during the courtship and nest-building period. Careless actions by photographers, bird-watchers, and drivers of all-terrain vehicles may potentially disturb nesting American Avocets in British Columbia.

7.6 Environmental Contamination

White et al. (1983) found that some American Avocets wintering on mudflats at the outlet of agricultural drains in Texas accumulated potentially dangerous levels of DDE. Despite the banning of DDT in the United States eight years previous to the study, levels of DDE high enough to be near the range known to inhibit reproduction were detected. Dietrich et al. (1997) suggested that the foraging preference of avocets for soft substrates combined with the accumulation of PCBs in fat tissues of their dominant prey made them particularly susceptible to elevated levels of organochlorines.

Extensive studies on selenium contamination have determined that elevated levels in breeding areas of nesting avocets has resulted in reproductive problems and recruitment failures (Williams et al. 1989; Ohlendorf et al. 1990). Dead and deformed embryos at Kesterson Reservoir, California were attributed to elevated concentrations of selenium found in eggs (Ohlendorf et al. 1990; Robinson et al. 1997). Fairbrother et al. (1994) noted impairment of

growth and immune function of avocet chicks from sites in the Central Valley of California with elevated levels of selenium, arsenic and boron.

8 SPECIAL SIGNIFICANCE OF THE SPECIES

8.1 Status

The American Avocet is currently considered at risk in British Columbia and is Blue-listed as a Vulnerable species by the B.C. Ministry of Environment (Fraser et al. 1999), due largely to its low abundance and restricted distribution in the province. It did not qualify for the Red List because the overall Canadian and North American population was increasing, and the B.C. population, although small, was thought to be undergoing a range expansion in the province (M. Chutter, pers. comm.). The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has not addressed the American Avocet.

8.2 Degree of Public Interest

The plight of avocets at the Glenmore Land Fill site in Kelowna has been regularly featured in local newspapers, on CBC radio, and CBC TV news reports, reflecting the high public concern for this species. The Central Okanagan Naturalists Club has taken an active role in pursuing opportunities to protect and enhance this species, and has garnered support from a number of organizations including the City of Kelowna, Canadian Wildlife Service, Okanagan University College, the Central Okanagan Foundation, and B.C. Ministry of Environment, Lands and Parks. American Avocets are highly prized by bird watchers and photographers wherever the birds are encountered in British Columbia. Some of these people make regular excursions to the Alki and Robert Lake areas to observe this conspicuous, and easily recognizable species.

8.3 Related Species

The American Avocet is the only *Recurvirostra* species occurring in North America. Three other species occur world-wide: 1) the Pied Avocet in Africa, Europe and Asia; 2) the Red-necked Avocet (*R. novaehollandiae*) endemic to Australia; and 3) the Andean Avocet (*R. andina*) found at high elevations in the Andes, South America (Hayman et al. 1986).

All four avocets have completely distinct ranges. Another related species to the American Avocet, the Black-necked Stilt (*Himantopus mexicanus*), breeds throughout North America south of the Canadian border - except for some breeding records in Alberta (Godfrey 1986) - to southern areas of South America (Hayman et al. 1986). It has only been reported occasionally in British Columbia as a summer visitor (Campbell et al. 1990).

9 RECOMMENDATIONS AND MANAGEMENT OPTIONS

9.1 Habitat Protection and Acquisition

Regular breeding sites for the American Avocet need to be protected. Sites where breeding has been recorded occasionally may not warrant full protection. Recent acquisition of a small parcel of Robert Lake by local conservation organizations is a small, positive step in long-term protection of foraging and breeding habitats of the American Avocet in the Kelowna area. Acquisition of other parcels at Robert Lake need to be actively pursued. Some protection opportunities may exist for some sites under the Range Use Plans, Riparian Management Guidelines, and Biodiversity Guidelines, of the Forest Practices Code of British Columbia. The American Avocet should be designated as Identified Wildlife under the Forest Practices Code IWMS, to enable habitat protection of critical sites on Crown land in the form of Wildlife Habitat Areas. Other opportunities for protection include stewardship on private lands, and designation as Ecological Reserves, parks or other protected areas.

9.2 Habitat Enhancement

Control of water levels can provide suitable foraging and breeding opportunities for avocets (Velasquez 1992; J. Robinson, pers. comm.). Creating additional habitat by releasing water into wetlands early in the breeding season in years when water levels are low may increase breeding success of avocets by reducing depredation rates and increasing food availability. Opportunities to enhance habitats within the property boundary of the Glenmore Land Fill should be explored since drainage interception and water control facilities will be established as part of the

proposed expansion of the site. It may be possible to incorporate wetland creation or maintenance into these waterworks or drainage features to benefit local breeding populations of avocets.

Flushing of hypersaline water out of a lagoon in Britain resulted in an increase in the Pied Avocet population from eight to approximately 220 birds (Hill 1989). Increased prey survival and densities were the primary factors improving chick survival in the study. It is unclear whether salinity is a factor in avocet reproductive success in British Columbia. Proposed research (see 10 "Research Needs") at Alki and Robert Lakes in 1999 may shed more light on the role of salinity in avocet reproductive success.

9.3 Habitat Creation

Giroux (1985) observed that artificial islands created for the benefit of waterfowl were used by nesting avocets, and Hill (1989) reported that creation of lagoons by topsoil removal have been successfully implemented in Britain. Burgess and Hiron (1992) determined that artificially created sparsely-vegetated islands and rafts attracted Pied Avocets in Britain.

A very successful habitat creation project on a 130 ha site in the Tulare Basin, California, supported 829 American Avocet nests in 1996 and 2,052 nests in 1998 (Robinson et al. 1997; D. Davis, pers. comm.). The site was arranged to provide 35, 1.6 km long x 20 m wide feeding lanes, alternating with 34 unvegetated and gradually sloping (12:1 slope) 10 m wide nesting lanes. Water depth in feeding lanes was maintained at 10-15 cm using a flow-through system. The perimeter of the site was bounded by electrified fence which kept nest depredation to less than one percent.

Opportunities to creating nesting islands need to be explored at Robert Lake and other wetlands. Lightly vegetated islands with protection from coyotes, dogs and other terrestrial mammals appear to provide the most important breeding habitat for avocets (L. Oring, pers. comm.). Studies have indicated that the further a nesting island is located from the shoreline, the less likely predators, such as coyotes, will impact nesting birds (J. Robinson, pers. comm.). Deeper water around islands appeared to be an important factor in nest-site selection for avocets in southwestern Alberta (Giroux 1985).

10 RESEARCH NEEDS

1. Opportunities to enhance existing breeding sites, particularly in the vicinity of Alki and at Robert Lake, need to be explored.
2. Habitat attributes necessary for successful breeding and foraging of the American Avocet within its range in British Columbia need to be determined as soon as possible in order to select priority sites for habitat enhancement or creation. Information that would assist in this process should be collected at Alki and Robert lakes and may include: a) food availability (i.e., invertebrate surveys); b) nesting and fledgling success; c) chick rearing areas; d) impacts of depredation; e) key nest site attributes; and f) availability of other suitable nesting habitats.
3. Suitable alkaline wetlands in the dry interior should be surveyed to determine range, population size, and breeding status of the American Avocet in the province, since Alki Lake may not be the only regular breeding site. (See footnote page 5). Interviews with local naturalists, ranchers and other land-owners may provide additional avocet sightings during the breeding season. Strategically placed adds and posters will also encourage observations to be reported.

11 EVALUATION

The only breeding sites known to have been used by the American Avocet in British Columbia since 1995 have been Alki and Robert lakes in Kelowna; (see footnote page 5), the former being a regular colonial nest site in 1997 and 1998, while the latter was used by one nesting pair in 1998. Although breeding populations have increased gradually at Alki Lake since breeding was first reported in 1987, the population is extremely vulnerable to habitat loss due to the proposed land fill expansion and fluctuations in water levels. High water levels in 1998 may have been a significant factor in limiting nesting. Without mitigative or enhancement initiatives, avocets may eventually be extirpated from Alki Lake and the Kelowna area. No other regularly used breeding areas

in British Columbia have been adequately documented. Nesting at three other sites, Duck Lake (1968), Beresford Lake (1987), and Little White Lake (1995) has only been reported in single years. Nesting at Serpentine Fen (1988 and 1989), Robert Lake (1992 and 1998), and "White" Lake (1990 and 1991) was reported for two years.

The American Avocet is currently Blue-listed by the province with global (G) and provincial (S) rankings of G5 and S2S3B, SZN, respectively (Fraser et al. 1999). The rankings use numbers 1 through 5, with 1 having the highest conservation concern and 5 the lowest. The G5 rating indicates that the status of the American Avocet throughout its entire range is common to very common, demonstrably secure and essentially ineradicable at the species level under present conditions. The S2S3B rating applies to its breeding (B) status within British Columbia. A '2' ranking indicates that the American Avocet is imperiled because of rarity (typically 6-20 extant occurrences or few remaining individuals) or because of some factor(s) making it vulnerable to extirpation or extinction. A '3' ranking indicates that it is rare or uncommon (typically 21-100 occurrences), and may be susceptible to large-scale disturbances. A double-listing such as the avocet's S2S3, indicates that not enough information was available at the time of listing to designate it distinctly into either of the two categories. Species ranked S1, S1S2, or S2 become Red-listed, while those ranked S2S3, S3, or S3S4 become Blue-listed. Information contained in this status report supports moving this species from the Blue List to the Red List. A summary of the author's proposed provincial ranking scores using the BC Conservation Data Centre's categories and provincial ranking guidelines is provided below ("A" = highest conservation concern; "E" = lowest).

Known occurrences: B (= 6-20 occurrences). Although seven breeding locations known, four sites have not been utilized since 1991. One nest was reported at Little White Lake near Clinton in 1995, but since then it has only been known to breed at Alki Lake (1997 and 1998) and Robert Lake (1998). It is possible that undiscovered breeding sites occur elsewhere in the province. (See footnote page 5).

Abundance: A (= <1,000 individuals). The highest count of avocets reported at Alki Lake was 39 (19 pairs) in 1997; populations in 1998 were lower at a maximum of 23 birds and a total of three nests. Based on sighting records (see Appendix 1), the

provincial population in any given year has likely never exceeded 50-75 birds.

Range: B (= very small range, less than 10% of the province) - only known to have bred in seven widely scattered sites, and only Alki Lake for more than two years. Breeding habitats appear to be limited to very localized sites in the Southern Interior and Central Interior ecoprovinces. Breeding records at Serpentine Fen, Surrey (Georgia Depression ecoprovince), and Duck Lake, Creston (Southern Interior Mountains ecoprovince), are considered to be outside the normal range of this species.

Trend: Unknown (possible C = stable) - provincial population appears to have increased slowly up 1997, although very few birds were reported in some years (e.g., 1986 and 1993; see Appendix 1). High water levels at breeding sites in Kelowna in 1998 resulted in only three nests reported at Alki Lake and one nest at Robert Lake. Nesting success was not determined. Future trend will likely be downward if habitat at Alki Lake is altered by the proposed land fill expansion activities.

Protected Occurrences: A (= none protected). None of the known nesting locations utilized in the last 10 years (since 1989) are protected. Historical, ephemeral nesting locations at Serpentine Fen (1989) and Duck Lake (1968) are protected within Wildlife Management Areas. However, a 'B' rating (= at least one protected site) or 'C' rating (= several protected sites) was not considered appropriate as the two protected sites have not been utilized for 10 years, and are considered to have been peripheral or extralimital breeding sites.

Threats: A (= very threatened, species or community directly exploited or threatened by natural or human-caused forces). The primary provincial breeding area at Alki Lake is imminently threatened by the proposed land fill expansion

Proposed Provincial Rank: S1S2B. An S1 ranking is defined as a species being either critically imperiled because of extreme rarity (5 or fewer occurrences or very few remaining individuals) or because of some factor making it especially vulnerable to extirpation or extinction). Due to the lack of surveys for breeding avocets, there is a possibility that some undiscovered nesting sites may exist in the province. This uncertainty warrants the S1S2B designation.

Comments: Currently (1998), the American Avocet is only known to breed at two locations (i.e.,

Alki and Robert Lakes) in British Columbia. Nesting attempts in 1998 declined to four nests from a high of 19 nests in 1997. Suitable nesting habitats in 1998 were reduced because of high water levels. Nesting success in 1999 is anticipated to be low because of continuing high water levels, and the Alki Lake site is threatened by land fill expansion. Destruction of the Alki Lake may result in extirpation of the Okanagan population. Provincial extirpation is also possible since birds have not nested outside of the Okanagan Valley since 1995. (See footnote page 5). The S1S2B rank warrants uplisting the American Avocet from the provincial Blue List to the Red List as a candidate for Endangered status. If nesting habitats at Alki Lake are lost, and additional breeding sites in the province are not discovered, the ranking should be changed to S1B. If the Alki Lake is protected and/or other habitats become breeding sites for avocets, consideration may be given to returning to an S2S3B rank and moving it back down to the Blue List as a Vulnerable species.

12 LITERATURE CITED

- Alberico, J.A.R. 1993. Drought and predation cause avocet and stilt breeding failure in Nevada. *Western Birds* 24: 43-51.
- B.C. Conservation Data Centre. 1999. Rare element occurrences, *Recurvirostra americana*. Report produced 26 February, 1999 for Enviro-Pacific Consulting, Surrey, BC. 9pp.
- B.C. Wildlife Branch. 1998. Memorandum: 1998 red and blue lists for amphibians, reptiles, birds, and mammals.
- Baichich, P.J., and C.J.O. Harrison. 1997. A guide to the nests, eggs, and nestlings of North American birds, second ed. Acad. Press, London, UK.
- Bent, A.C. 1927. Life histories of North American shore birds, Order Limicolae (Part 1). U.S. Natl. Mus., Bull. 142.
- Boettcher, R., S.M. Haig and W.C. Bridges, Jr. 1995. Habitat-related factors affecting the distribution of nonbreeding American Avocets in coastal South Carolina. *The Condor* 97:68-81.
- Breeding Bird Survey. 1998. Breeding Bird Survey results for American Avocet, *Recurvirostra americana*. Maps and trend tables. At <http://www.mbr.nbs.gov/id/mlist/h2250.html>; and <http://www.mbr-pwrc.usgs.gov/bbs/bbs.html>.
- Brooks, A. 1909. Some notes on the birds of Okanagan, British Columbia. *The Auk* 26:60-63.
- Brooks, A., and H.S. Swarth. 1925. A distributional list of the birds of British Columbia. Cooper Ornithol. Club, Pacific Coast Avifauna No. 17.
- Burgess, N.D., and J.M. Hirons. 1992. Creation and management of artificial nesting sites for wetland birds. *J. Environ. Manage.* 34(4):285-295.
- Cadbury, C.J., and P.J.A. Olney. 1978. Avocet population dynamics in England. *British Birds* 71:102-121.
- Campbell, R.W. 1972. The American Avocet (*Recurvirostra americana*) in British Columbia. *Syesis* 5:173-178.
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. The birds of British Columbia - Diurnal birds of prey through woodpeckers. Royal B.C. Mus., Victoria, BC and Can. Wildl. Serv. Delta, BC. 636pp.
- Cannings, R.A., R.J. Cannings and S.G. Cannings. 1987. Birds of the Okanagan Valley, British Columbia. Royal B.C. Mus., Victoria, BC. 420pp.
- Chepeau, Y., S. Le Dreun Quenec'Hdu. 1995. Preliminary evaluation of the characteristics of nocturnal feeding sites of avocets, *Recurvirostra avosetta*, on the Guerande peninsula, western France. *Alauda* 63(3):169-178.
- Colwell, M.A., and L.W. Oring. 1990. Nest-site characteristics of prairie shorebirds. *Can. J. Zool.* 68:297-302.
- Cooper, J.M. 1983. Recent occurrences of the American Avocet in British Columbia. *The Murrelet* 64:47-64.
- Davis, C.A., and L.M. Smith. 1998. Ecology and management of migrant shorebirds in the Playa Lakes Region of Texas. *Wildl. Monogr.* 140:1-45.
- Demarchi, D.A. 1995. Ecoregions of British Columbia, 4th Edition. B.C. Minist. Environ, Lands and Parks, Victoria, BC. Map (1:2,000,000).
- Dietrich, S., A. Buthe, E. Denker and H. Hotker. 1997. Organochlorine in eggs and food organisms of avocets (*Recurvirostra avosetta*). *Bull. Environ. Contamination and Toxicol.* 58:219-226.

- Dodd, S.L., and M.A. Colwell. 1996. Seasonal variation in diurnal and nocturnal distributions of nonbreeding shorebirds at North Humboldt Bay, California. *The Condor* 98:196-207.
- Ehrlich, P.R., D.S. Dobkin and D. Wheye. 1988. *The birder's handbook: a field guide to the natural history of North American birds*. Simon and Schuster Inc., New York, NY. 785pp.
- Evans, T.J., and S.W. Harris. 1994. Status and habitat use by American Avocets wintering at Humboldt Bay, California. *The Condor* 96:178-189.
- Fairbrother, A., M. Fix, T. O'Hara and C.A. Ribic. 1994. Impairment of growth and immune function of avocet chicks from sites with elevated selenium, arsenic, and boron. *J. Wildl. Diseases* 30(2):222-233.
- Fraser, D.F., W.L. Harper, S.G. Cannings, and J.M. Cooper. 1999. Rare birds of British Columbia. B.C. Minist. Environ., Lands and Parks, Wildl. Branch and Resour. Inv. Branch. Victoria, BC. 236pp.
- Gibson, F. 1971. The breeding biology of the American Avocet (*Recurvirostra americana*) in central Oregon. *The Condor* 73:444-454.
- Giroux, J-F. 1985. Nest sites and superclutches of American Avocets on artificial islands. *Can. J. Zool.* 63:1302-1305.
- Godfrey, W.E. 1986. *The birds of Canada*. Natl. Mus. Can., Ottawa, ON. 595pp.
- Goutner, V. 1997. Use of the Drana Lagoon (Evros Delta, Greece) by threatened colonially nesting waterbirds and its possible restoration. *Biol. Conserv.* 81:113-120.
- Grover, P.B., and F.L. Knopf. 1982. Habitat requirements and breeding success of Charadriiform birds nesting at Salt Plains National Wildlife Refuge, Oklahoma. *J. Field Ornithol.* 53(2):139-148.
- Hayman, P., J. Marchant and T. Prater. 1986. *Shorebirds: an identification guide*. Houghton Mifflin Co., Boston, MA. 412pp.
- Hill, D.A. 1989. Manipulating water habitats to optimise wader and wildfowl populations. pp. 328-343. *In* G.P. Buckley, ed. *Biological habitat reconstruction*. Belhaven Press, London, UK.
- Howell, S.N.G., and S. Webb. 1995. *A guide to the birds of Mexico and northern Central America*. Oxford Univ. Press, New York, NY. 851pp.
- Koenigstedt, D.G.W., D. Robel and W. Gottschalk. 1991. Investigations on the breeding biology, ecology and status of some bird species on the Burgas Salt-Pans, Bulgaria. *Zoologische Jahrbuecher Abteilung Fuer Systematik Oekologie und Geographie der Tiere* 118 (1):117-146.
- Kondla, N.G., and H.W. Pinel. 1978. Clutch size of the American Avocet in the prairie provinces. *Blue Jay* 36(3):150-153.
- Kuyt, E., and B.W. Johns. 1992. Recent American Avocet, *Recurvirostra americana*, breeding records in the Northwest Territories, with notes on avocet parasitism of mew gull, *Larus canus*, nests. *Can. Field-Nat.* 106(4):507-510.
- Mahoney, S.A., and J.R. Jehl, Jr. 1985. Adaptations of migratory shorebirds to highly saline and alkaline lakes: Wilson's Phalarope and American Avocet. *The Condor* 87:521-527.
- Munro, J.A., and I. McTaggart-Cowan. 1947. A review of the bird fauna of British Columbia. British Columbia Provincial Mus., Spec. Publ. No. 2. 285pp.
- Nature Mapping. 1997. Nature Mapping wildlife observations with the Washington Gap Analysis Project's predicted distributions - American Avocet. Map. At <http://salmo.cqs.washington.edu/~wagap/nm/bream.html>
- Ohlendorf, H.M., R.L. Hothem, C.M. Bunck and K.C. Marois. 1990. Bioaccumulation of selenium in birds at Kesterson Reservoir, California. *Archives Environ. Contamination and Toxicol.* 19:495-507.
- Porter, R.D., and C.M. White. 1973. The peregrine falcon in Utah, emphasizing ecology and competition with the prairie falcon. *Brigham Young Univ., Sci. Bull. Biological Ser.* 18:1-74.
- Price, J., S. Droege and A. Price. 1995. *The summer atlas of North American birds*. Acad. Press Ltd., London, UK.
- Province of British Columbia. 1997. *Forest Practices Code of British Columbia - Species and plant community accounts for identified wildlife, Volume 1*. Queen's Printer, Victoria, BC, 171pp.

- Robinson, J.A., and L.W. Oring. 1997. Natal and breeding dispersal in American Avocets. *The Auk* 114(3):416-430.
- Robinson, J.A., L.W. Oring, J.P. Skorupa, and R. Boettcher. 1997. American Avocet (*Recurvirostra americana*). 32pp. In A. Poole and F. Gill, eds. *The Birds of North America*, No. 275. The Acad. Nat. Sci., Philadelphia, PA, and The Amer. Ornithol. Union, Washington, DC.
- Safran, R.J., C.R. Isola, M.A. Colwell and O.E. Williams. 1997. Benthic invertebrates at foraging locations of nine waterbird species in managed wetlands of the northern San Joaquin Valley, California. *Wetlands* 17(3):407-415.
- Semenchuk, G. (ed.). 1992. *The atlas of breeding birds of Alberta*. Fed. Alberta Nat., Edmonton, AB.
- Shipley, F.S. 1984. The 4-egg clutch limit in the Charadrii: an experiment with American Avocets. *Southwestern Nat.* 29(2):143-147.
- Sordahl, T.A. 1982. Antipredator behavior of American Avocet and Black-necked Stilt chicks. *J. Field Ornithol.* 53(4):315-325.
- Sordahl, T.A. 1996. Breeding biology of the American Avocet and Black-necked Stilt in northern Utah. *Southwestern Nat.* 41(4):348-354.
- Taverner, P.A. 1934. *Birds of Canada*. Natl. Mus. Canada, Bull. No. 72, Biol. Ser. No. 19.
- Tera Planning Ltd. 1993. Environmental assessment of Robert Lake. Prepared for The City of Kelowna, Eng. Dep. 30pp.
- Urban Systems. 1998. Wetland habitat management strategy, November 1998. Prepared for City of Kelowna, Planning and Dev. Serv. 51pp.
- Velasquez, C.R. 1992. Managing artificial saltpans as a waterbird habitat: species' responses to water level manipulation. *Colonial Waterbirds* 15(1):43-55.
- Weber, L.M., and S.M. Haig. 1996. Shorebird use of South Carolina managed and natural coastal wetlands. *J. Wildl. Manage.* 60(1):73-82.
- Weir, J. 1997a. The breeding biology of a British Columbia American avocet colony. *British Columbia Birds* 7:3-7.
- Weir, J. 1997b. Great birding at avocet marsh. *B.C. Birding* 7(3):16-18.
- White, D.H., C.A. Mitchell and T.E. Kaiser. 1983. Temporal accumulation of organochlorine pesticides in shorebirds wintering on the South Texas Coast, 1979-80. *Archives Environ. Contamination and Toxicol.* 12:241-245.
- Williams, M.L., R.L. Hothem and H.M. Ohlendorf. 1989. Recruitment failure in American Avocets and Black-necked Stilts nesting at Kesterson Reservoir, California, 1984-1985. *The Condor* 91:797-802.
- Wilson, D.J. 1989. Avocets on the B.C. coast: first breeding record. *Discovery* 18(3):95-97.

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Appendix 1. List of American Avocet sightings in British Columbia. Primary sources include Cannings et al. (1987), Campbell et al. (1990) and unpublished records of naturalists. Other sources are listed in the table. Breeding records are indicated in bold print.

Date	Location	Number/Sex/Comments	Observer/Source
28/04/08	Okanagan Landing	15 ad.	Brooks 1909
??/??/14	Mud Bay, Boundary Bay	1 individ.; no details	Campbell 1972
20/09/15	Mouth of Fraser River	1 individ. Shot	Brooks & Swarth 1925
15/05/25	Lower Arrow Lakes	Approx. 10-15 ad.	Munro & Cowan 1947
??/??/48	Alki Lake, Kelowna	3 individ.	Wayne Campbell
15/05/55	Iona Island, Richmond	1 ad.	Campbell 1972
21/04/59	Okanagan Lake, Kelowna	9 ad.	Campbell 1972
??/05/61	Horsehoe Lake, S. of Fort Steele	1 pair	Campbell 1972
20/05/61	Celista	1 ad. present to 21 May	Campbell et al. 1990
??/05/62	Canal Flats, Kootenays	3 ad.	Campbell 1972
??/05/62	Wasa Sloughs, Wasa	6 ad.	Campbell 1972
10/04/62	Celista	1 ad.	Campbell et al. 1990
??/04/63	West Kootenays	2 pairs nesting; no other details	Campbell 1972
25/04/64	Duck Lake, Creston	1 pair	Campbell 1972
24/05/64	O'Keefe's Pond, Vernon	1 ad.	Campbell 1972
??/09/64	Hemp Creek, Wells Gray Park	1 individ.	Campbell 1972
10/05/68	Duck Lake, Creston	2 ad. (1 nest with 3 eggs)	Campbell 1972
11/05/68	Iona Island, Richmond	up to 3 ad. until 12 June	Campbell 1972
12/05/68	Ellison (Duck) Lake, Winfield	1 ad.; remained until 20/05/68	Campbell 1972
13/06/69	Iona Island, Richmond	2 individ.	Campbell 1972
22/06/69	Iona Island, Richmond	2 individ.	Campbell 1972
20/05/70	Iona Island, Richmond	1 ad.	Campbell 1972
??/06/72	West end Williams Lake	1 pair exhibiting courtship beh.	Cooper 1983
14/05/74	Saanich, Vancouver Island	1 ad.	Campbell et al. 1990
29/04/76	Trail	7 ad.	Campbell et al. 1990
02/05/76	Okanagan Lake, Penticton	9 ad.	Cannings <i>et. al.</i> 1987
15/05/76	Riske Creek	1 ad.	Campbell et al. 1990
10/05/77	Wasa Lake	12 ad.	Campbell et al. 1990
10/05/77	Trout Creek, Okanagan Lake	12 ad.	Cannings <i>et. al.</i> 1987
13/07/77	Farrel Creek, Hudson Hope	1 individ.	Campbell et al. 1990
28/05/78	Nakusp	1 ad.	Campbell et al. 1990
01/10/79	Saanich, Vancouver Island	1 individ.	Campbell et al. 1990
25/07/79	Iona Island, Richmond	1 individ.	Campbell et al. 1990
10/05/80	Robert Lake, Kelowna	1 ad.	Cannings <i>et. al.</i> 1987
24/05/80	Chilanko Forks	1 ad.	Campbell et al. 1990
??/06/80	Kootenay R. 10 km S of Kootenay N.P.	3 ad.	Les Gyug
05/08/81	Reifel Island, Richmond	1 individ.	Campbell et al. 1990
14/05/82	Tranquille	6 ad.	Ralph Ritcey
22/05/83	Fort St. John	4 ad.	Campbell et al. 1990
23/05/83	N. Sewage Lagoons, Fort St. John	1 ad.	Chris Siddle

Date	Location	Number/Sex/Comments	Observer/Source
28/05/83	N. Sewage Lagoons, Fort St. John	4 ad.	Chris Siddle
24/05/84	Fort St. John	2 ad.	Chris Siddle
01/05/85	Swan Lake, Vernon	1 ad.	Cannings <i>et. al.</i> 1987
04/05/85	Reifel Island, Delta	1 ad. present to 07 May	Campbell <i>et al.</i> 1990
15/05/85	Mabel Lake	9 ad.; exact date unknown	Campbell <i>et al.</i> 1990
31/08/85	Boundary Bay	3 individ.	Campbell <i>et al.</i> 1990
20/04/86	Duck Lake, Creston	1 ad.	Campbell <i>et al.</i> 1990
25/05/86	Sea Island, Richmond	1 ad.	Campbell <i>et al.</i> 1990
29/05/86	Williams Lake	1 ad.	Campbell <i>et al.</i> 1990
05/09/86	Iona Island, Richmond	1 individ. Present to 04 Dec	Campbell <i>et al.</i> 1990
06/09/86	Jericho Park, Vancouver	1 individ. Present to 12 Sep	Campbell <i>et al.</i> 1990
22/04/87	MacArthur Island, Kamloops	11 ad.	Mike Jorgenson
28/04/87	Beresford Lake, SE of Kamloops	2 ad. present to 09 June	Rick Howie, Dave Fraser
04/05/87	Beresford Lake, SE of Kamloops	Nest with 4 eggs	Campbell <i>et al.</i> 1990
18/05/87	Beresford Lake, SE of Kamloops	fem. on 4 eggs to 09 June	Rick Howie, Dave Fraser
07/05/87	Tofino, Vancouver Island	4 ad.	Campbell <i>et al.</i> 1990
12/05/87	Serpentine Fen, Surrey	up to 4 ad.; present to 21 May	Wilson 1989
16/05/87	Alki Lake, Kelowna	4 ad.	Cannings <i>et. al.</i> 1987
17/05/87	Buse Lake, SE of Kamloops	2 ad.	Ros Eldridge
04/06/87	Meadow Lake	2 ad.	Campbell <i>et al.</i> 1990
05/06/87	Alki Lake, Kelowna	4 ad.; nesting suspected	Cannings <i>et. al.</i> 1987
08/06/87	Buse Lake, near Kamloops	2 individ.	Eric McAlary
16/06/87	Beresford Lake, SE of Kamloops	no birds; 1 unhatched egg	Rick Howie
25/06/87	Alki Lake, Kelowna	4 ad; 6 juv.; present to 04 Jul	Cannings <i>et. al.</i> 1987
10/07/87	Kelowna	10 individ.	Campbell <i>et al.</i> 1990
??/04/88	Alki Lake, Kelowna	1 ad.	Martin Gebauer
15/04/88	Douglas Lake	1 ad.	Rick McKelvey
18/04/88	Okanagan Lake	13 ad.	Campbell <i>et al.</i> 1990
21/04/88	Burges and James Gadsen Park	1 ad.	Campbell <i>et al.</i> 1990
24/04/88	Iona Island, Richmond	1 ad.	Wilson 1989
24/04/88	Serpentine Fen, Surrey	1 ad.	Wilson 1989
05/05/88	Fort St. John	max. 19 ad. present to 12 May	Chris Siddle
07/05/88	Cecil Lake, Fort St. John	2 ad.	Campbell <i>et al.</i> 1990
07/05/88	Duck Lake, Creston	max. 18 ad. present to 08 May	Campbell <i>et al.</i> 1990
08/05/88	Serpentine Fen, Surrey	4 ad.	Wilson 1989
10/05/88	Okanagan Lake	5 ad.	Campbell <i>et al.</i> 1990
15/05/88	Serpentine Fen, Surrey	5 ad. (2 pairs, 1 fem.)	Wilson 1989
16/05/88	Alki Lake, Kelowna	2 ad.	Martin Gebauer
21/05/88	Robert Lake, Kelowna	2 ad. copulating	Dick Cannings
21/05/88	Alki Lake, Kelowna	2 ad.	Wayne Weber

Date	Location	Number/Sex/Comments	Observer/Source
22/05/88	Robert Lake, Kelowna	1 ad.	Campbell et al. 1990
22/05/88	Alki Lake	6 ad.	Campbell et al. 1990
01/06/88	Serpentine Fen, Surrey	6 ad.	Wilson 1989
09/06/88	Serpentine Fen, Surrey	2 nests with four eggs each	Wilson 1989
22/06/88	Serpentine Fen, Surrey	4 juv., 4 ad.	Wilson 1989
25/06/88	Iona Island, Richmond	2 ad. present to 26 June	Wilson 1989
28/06/88	Serpentine Fen, Surrey	4 ad., no young	Wilson 1989
27/08/88	Maplewood Flats, N. Vancouver	1 of unknown age	Wilson 1989
??/?/89	Serpentine Fen, Surrey	1 pair	Campbell et al. 1990
08/05/89	"White" Lake (Kame Lakes area), Douglas Plateau	2 ad. also observed 09 May	Rick McKelvey
21/05/89	Alki Lake, Kelowna	1 m., 1 f.	Dick Cannings
21/05/89	Robert Lake, Kelowna	1 m., 1 f.	Dick Cannings
17/05/89	Alki Lake, Kelowna	1 - 3 ad. observed to 19 May	Dick Cannings
02/06/89	Afton Mine pond	1 individ. also seen 03 June	Rick Howie
14/06/89	Rose Hill, SE of Kamloops	2 individ.	Ros Eldridge
06/07/89	Wallender Lake, SE of Kamloops	2 individ.	Rick Howie
22/09/89	Iona Island, Richmond	2 individ.	Andy Stewart
22/09/89	Storey Beach, Port Hardy	2 individ.	D. Howard, T. Lyon
23/04/90	"White" Lake, (Douglas Plateau)	2 ad.	Rick McKelvey
07/05/90	"White" Lake (Douglas Plateau)	2 ad. copulating	Doug Jury
08/05/90	Beresford Lake, SE of Kamloops	4 ad.	Rick Howie
12/05/90	"White" Lake (Douglas Plateau)	10 ad.	Rick McKelvey
??/06/90	"White" Lake (Douglas Plateau)	2 nests	Wayne Campbell
01/06/90	Iona Island, Richmond	1 ad. until 03 June	Rick Toochin, B. Gates
21/04/91	Kelowna	7 ad.	Denise Brownlie
25/04/91	Swan Lake, Vernon	3 ad.	Chris Siddle
01/05/91	Beaver Ranch Flats, Stumplake Ck	5 ad.	Rick Howie
02/05/91	Tranquille	5 ad.	Syd Roberts
15/05/91	Buse Lake, near Kamloops	4 ad.	Rick Howie
19/05/91	Beresford Lake, SE of Kamloops	2 ad.	Rick Howie
22/05/91	Revelstoke	3 ad.	E. Tremblay, D. Powell
30/05/91	"White" Lake (Douglas Plateau)	11 ad., 2 nests with 4 eggs	NVIT*
02/06/91	Buse Lake, SE of Kamloops	1 ad.	Rick Howie
06/06/91	"White" Lake (Douglas Plateau)	11 ad., one nest destroyed	NVIT
25/06/91	"White" Lake (Douglas Plateau)	4 young fledged	NVIT
03/07/91	Mitchell Lake, SE of Kamloops	1 individ.	Rick Howie
05/07/91	"White" Lake (Douglas Plateau)	11 ad.	NVIT

* NVIT = Nicola Valley Institute of Technology students doing avocet monitoring

Date	Location	Number/Sex/Comments	Observer/Source
05/08/91	Chichester Marsh, Kelowna	2 individ.	Chris Charlesworth
19/08/91	Robert Lake, Kelowna	2 individ.	Chris Charlesworth
27/04/92	Mitchell Lake, SE of Kamloops	2 ad.	Rick Howie
28/04/92	Barnes Lake, Ashcroft	1 ad.	Rick Howie
28/04/92	Beaver Ranch Flats, Stumplake Cr.	2 ad.	Rick Howie
01/05/92	Revelstoke	1 ad.	G. Winingder
12/05/92	Cranberry Marsh, Valemount	3 ad.	D. Wilkinson, C. Hiroe
14/05/92	Courtney	1 ad.	Various observers
16/05/92	Buse Lake, SE of Kamloops	2 ad.	Rick Howie
17/05/92	Robert Lake, Kelowna	5 ad.	Dick Cannings
17/05/92	Alki Lake, Kelowna	2 ad.	Dick Cannings
17/05/92	Beaver Ranch Flats, Stumplake Cr.	8 ad.	Rick Howie
17/05/92	Dry Valley, Kelowna	2 ad.	Dick Cannings
24/05/92	Robert Lake, Kelowna	3 ad., 1 nest with four eggs	Chris Siddle
11/06/92	Robert Lake, Kelowna	8 ad.	Chris Charlesworth
16/06/92	Robert Lake, Kelowna	3 ad., nest with only one egg	Chris Siddle
19/06/92	Beaver Ranch Flats, Stumplake Cr.	1 ad.	Dick Cannings
03/07/92	Kamloops	1 individ.	Wayne Weber
11/07/92	Robert Lake, Kelowna	4 individ.	Chris Charlesworth
03/11/92	Chilliwack	2 individ.	G. Gadsden
23/05/93	Robert Lake, Kelowna	1 ad.	Chris Charlesworth
29/05/93	Afton Mine pond, Kamloops area	1 ad.	Ros Eldridge
16/04/94	Robert Lake, Kelowna	2 ad.	Chris Charlesworth
17/04/94	Acland Road Pond, Kelowna	5 ad.	Chris Charlesworth
23/04/94	Alki Lake, Kelowna	6 ad.	Chris Charlesworth
23/04/94	Beaver Ranch Flats, Stumplake Cr.	2 ad.	Rick Howie
27/04/94	Ladner	2 ad.	Various observers
02/05/94	Barnes Lake, Ashcroft	4 ad.	Ian Barnett
16/05/94	Chichester Bird Sanct., Kelowna	8 ad.	Chris Charlesworth
22/05/94	Alki Lake, Kelowna	3-8 ad. present to 28 May	Chris Charlesworth
22/05/94	Tranquille	1 ad.	Syd Roberts
22/05/94	Robert Lake, Kelowna	1 ad.	Dick Cannings
24/05/94	Chichester Bird Sanct., Kelowna	1 ad.	Chris Charlesworth
24/05/94	Kelowna	8 ad.	Various observers
27/05/94	Westham Island, Delta	1 ad. until 30 May	A. Cassidy, J. Ireland
29/05/94	Barnes Lake, Ashcroft	1 ad.	Fred Harper
14/07/94	Robert Lake, Kelowna	4 to 5 individ. to 22 July	Chris Charlesworth
25/04/95	Chichester Bird Sanct., Kelowna	6 ad.	Chris Charlesworth
03/05/95	Chichester Bird Sanct., Kelowna	3-6 ad. present to 05 May	Chris Charlesworth
11/05/95	Beresford Lake, SE of Kamloops	2 ad.	Ian Barnett

Date	Location	Number/Sex/Comments	Observer/Source
17/05/95	Polygon Pond, Kamloops	2 ad.	Ian Barnett
20/05/95	Alki Lake, Kelowna	4-10 ad. present to 21 May	Chris Charlesworth
??/06/95	Little White Lake, W. of Clinton	1 pair	Daphne Ogilvie
18/05/96	Alki Lake, Kelowna	18 ad.	Martin Gebauer
19/05/96	Alki Lake, Kelowna	16 ad.	Dick Cannings
04/06/96	Rithets Bog, Victoria	1 ad.	L. Durda et al.
22/07/96	Robert Lake, Kelowna	3 individ.	Chris Charlesworth
15/04/97	Trout Creek mouth, Summerland	7 ad.	Clemens Hackenberg
16/04/97	Okanagan Lake, Kelowna	2 ad.	Weir 1997a
18/04/97	Alki Lake, Kelowna	20 ad.	Weir 1997a
19/04/97	Alki Lake, Kelowna	11 ad.	Chris Charlesworth
27/04/97	Alki Lake, Kelowna	37 ad.	Weir 1997a
13/05/97	Alki Lake, Kelowna	15 active nests	Weir 1997a and 1997b
16/05/97	Alki Lake, Kelowna	39 ad.	Weir 1997a
17/05/97	Maplewood Flats, N. Vancouver	1 ad.	Jack Bowling
10/06/97	Alki Lake, Kelowna	19 active nests	Weir 1997a
17/06/97	Alki Lake, Kelowna	23 ad.	Dick Cannings
17/07/97	Alki Lake, Kelowna	30 individ.	Weir 1997a
04/08/97	Alki Lake, Kelowna	1 ad.	Dick Cannings
22/08/97	Alki Lake, Kelowna	8 ad., 1 juv.	Weir 1997a
19/10/97	Serpentine River mouth, Surrey	3 individ. seen to 19 Nov	Susan Rothstein
24/10/97	Boundary Bay, Delta	1 individ. seen to 26 Oct	Wayne Weber
20/11/97	Serpentine River mouth, Surrey	5 individ.	Susan Rothstein
25/03/98	Serpentine River mouth, Surrey	4 individ, apparently overwint.	Jack Bowling
20/04/98	Chichester Bird Sanct., Kelowna	1 ad.	Doreen Wierenga
22/04/98	Robert Lake, Kelowna	3 ad.	Lee Riggs
23/04/98	Alki Lake, Kelowna	19 ad.	CONC birders group
03/05/98	Alki Lake, Kelowna	23 ad.	Les Gyug
13/05/98	Reifel and Iona Islands	1 individ. seen to 17 May	John Ireland
18/05/98	Alki Lake, Kelowna	1 nest with 2 eggs	Les Gyug, Bruce Ryder
24/05/98	Duck Lake, Creston	1 individ.	Burke Korol
27/05/98	Alki Lake, Kelowna	2 nd nest with 4 eggs on dike	Les Gyug, Jason Weir
??/06/98	Alki Lake, Kelowna	3 rd nest with 4 eggs on dike	Jason Weir
18/06/98	Robert Lake, Kelowna	1 nest with four eggs; 11 ad.	Les Gyug

Wildlife Working Reports may be cited, but the preliminary nature of the data they contain should be noted. Working Reports 1-39 (and certain others) are presently out of print, but photocopies may be available through the Wildlife Branch, Ministry of Environment, Lands and Parks or other agencies. Titles of Working Reports 1-39 are available on request.

- WR-40 Wolf-prey dynamics. Proceedings of a symposium sponsored by B.C. Ministry of Environment, Wildlife Branch, Faculty of Forestry, University of British Columbia and the Northwest Wildlife Preservation Society. February 1989. 188pp.
- WR-41 Caribou research and management in B.C.: proceedings of a workshop. R. Page, ed. November 1988. 275pp. (Also printed as WHR-27)
- WR-42 Trapping in British Columbia - a survey. R. Reid. January 1989. 55pp.
- WR-43 Biophysical habitat units of the Lower Halfway study area: expanded legend. E.C. Lea and L.E.H. Lacelle. December 1989. 33pp.
- WR-44 Long range habitat planning: proceedings. M. Fenger and V. Stevens, eds. March 1990. 49pp.
- WR-45 Biophysical habitat units of the Mosley Creek study area: expanded legend and interpretations. E.C. Lea and R.C. Kowall. March 1990. 33pp.
- WR-46 Habitat Management Section. Annual General Meeting. Yellowpoint Lodge - 1989 April 25-27. Wildlife and Recreational Fisheries Branches, Ministry of Environment. July 1990. 107pp.
- WR-47 Working plan — Khutzeymateen Valley grizzly bear study. A.N. Hamilton and J.A. Nagy. September 1990. 35pp. (Also printed as WHR-28).
- WR-48 Khutzeymateen Valley grizzly bear study. Annual progress report - year 1 (1989/90), annual working plan - year 2 (1990/91). J.A. Nagy and A.G. MacHutchon. January 1991. 44pp. (Also printed as WHR-29).
- WR-49 Fort Nelson and area average winter maximum snowpack mapping. R. Chilton. July 1990. 12pp.
- WR-50 Marten habitat suitability research project - working plan. E.C. Lofroth and V. Banci. January 1991. 31pp.
- WR-51 Khutzeymateen Valley grizzly bear study. Annual progress report - year 2 (1990/91), annual working plan - year 3 (1991/92). A.G. MacHutchon and S. Himmer. March 1992. 36pp. (Also printed as WHR-30)
- WR-52 Abundance, Distribution and Conservation of Birds in the Vicinity of Boundary Bay, B.C. R.W. Butler, ed. 1992. 132pp. (Also printed as Technical Report Series No. 155, Pacific and Yukon Region, Can. Wildlife Service).
- WR-53 Status of the Clouded Salamander in British Columbia. T.M. Davis and P.T. Gregory. March 1993. 19pp.
- WR-54 Status of the Northern Pacific Rattlesnake in British Columbia. M.B. Charland, K.J. Nelson, P.T. Gregory. March 1993. 23pp.
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